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THE WESTERN GAS ASSOCIATION MOVING IN THE MATTER OF STATE GAS COMMISSIONS.

Looking over the records of the recent annual assemblages of our Associations of gas engineers, it will be noted that one topic has, at one or more times during the progress of the sessions, been mooted with great earnestness. Its presentation has been a strong feature in several of the annual messages delivered by the Presidents of these bodies; and beyond all question such utterances have been attentively listened to and eagerly discussed. But while attention and eagerness have marked the reception of the points made in the messages, it must be confessed that, so far, no surprising volume of concerted action has resulted from the agitation of the question of the formation of State Gas Commissions. It is perhaps easy to understand that such a radical measure would require time to pass before a certain feeling of timidity, regarding the taking of the initial practical steps for its development, could be overcome; but the time for such timorousness to be excusable having passed away, longer dilatoriness may be fairly charged either to wilful neglect, slothfulness, or abject cowardice—any one of which, we submit, would constitute rather a lame defence. The New England Association of Gas Engineers (whose 16th annual meeting will be in progress at Providence, R. I., by the time this issue reaches our subscribers) at its last annual session practically led the way in this matter by the adoption of a resolution* endorsing and urging the passage of the gas commission bill which at the time was being considered in the Massachusetts legislative assembly. It will no doubt be remembered that, in its original form, the resolution of endorsement submitted by Mr. Slater "* * heartily approves of the effort * * to have a gas commission appointed * * * and recommends that similar action be taken in all the New England States." In the debate that took place over the wording of the Slater resolution, the temper of the members was shown to be, as a rule, welded to such a degree as to cause the words, "in all the New England States," to be stricken out and replaced by the assertion, "believing that it is the proper policy to be pursued, and that it will result in important advantages," etc. In truth, the only reason why the words, "United States" were not inserted in lieu of "New England States" was simply because some of those who took part in the discussion feared their brethren in other sections of the country might possibly regard such "wholesale advice" as not far short of presumptuousness. Fairly speaking for ourselves, we regarded those reasons as bordering on the finical; and because we think it time that the gas men of this country should regard those who labor honestly in their mutual art and industry as the factors of one common brotherhood; a brotherhood confined only between the points where solid earth ends and water begins. However, the New England Association took the initiative; and at the Cincinnati meeting of the American Association (Oct. 1885) further solid progress was made. Further than this mere hint at the action then taken we cannot give details, since the seal of secrecy has been imposed upon us in regard thereto. The time will come when that history may be recorded. What we really seek now to accomplish is to call attention to a circular that is being mailed to the fraternity throughout the country, and which emanates from the committee appointed at the last meeting of the Western Gas Association, in response to suggestions made in the annual address of President Lansden. The original purpose was to have had a report on the subject made to the members of the Association at an hour

*See JOURNAL, for March 16th, 1885, pp. 144-147.

prior to the final adjournment of session of 1885; but the gentlemen to whom it was referred, after short deliberation, concluded that the questions involved were of far too weighty a nature to admit of any such hasty disposition. They, in turn, reported back they would recommend the Chair to appoint a committee of three "whose duty it should be to as thoroughly as possible investigate the subject, and report their conclusions thereon at the next (1886) annual meeting." This sensible request was adopted; and, as the first move in the premises, we are in receipt of the following letter and circular:

"VINCENNES, IND., Feb. 8, 1886.

"Dear Sir:—The following committee—Samuel Prichitt, President Nashville (Tenn.) Gas Light Co.; T. A. Cosgrove, Treasurer Evanston (Ills.) Gas Light Co.; and G. G. Ramsdell, Secy. and Treas. Vincennes (Ind.) Gas Light Co.—was appointed by the Western Gas Light Association, at its meeting held at Chicago, in May last, to report to the next meeting, to be held at Columbus, Ohio, on the subject of Gas Commissions.

"We desire to gather the views of some of the most prominent members of the profession, and all the available testimony possible on either side of the question, and found our report upon the knowledge so gained. We deem the subject of the greatest importance, and therefore seek the fullest expression of opinion. We submit a series of questions covering some of the points on which there is diversity of opinion, which we trust you will answer and return. We do not desire, however, to limit your remarks in any way; and hope you will not only answer the questions but give any other information you have, as well as fully express your opinion. Any assistance you can afford us will be highly appreciated, and we sincerely trust will be for the best interests of all concerned.

"Any communication will be regarded as confidential, if you so desire. An early reply will greatly oblige. Truly yours,

"GEO. G. RAMSDELL, Secy."

The following is a copy of the circular enumeration of questions:

1.—Do you approve of State Gas Commissions, such as the one recently appointed and now in operation in Massachusetts?

2.—In your judgment, would it be desirable to have a similar Board in each of the States?

3.—Would you consider the protection such commission afforded an equivalent for the restrictions it would impose?

4.—In your judgment, is there danger of such boards becoming corrupt, and using their official power to the injury of the gas companies?

5.—Do you think there is any reason why—if the Gas Commission is successful, and approved by gas companies generally—similar Commissions would not be equally successful in the West and South?

6.—Do you believe that such a Commission in your own State would afford protection to the gas companies from "raiders" and "blackmailing schemes?"

7.—If you were a member of this Committee, with your present knowledge of the subject, would you report favorably or unfavorably?

From the above it will be seen that the Committee means "business," and we hope that the gentlemen who individually receive copies of the letter and circular will deal with the matter in proper spirit and with no hesitancy of action. As to our own views on the subject, they have been public property for years back; and our tenets thereon grow stronger with every passing day.

OUR DRAFT TO MR. BENNETT.

On Friday, February fifth, the proprietors of this JOURNAL purchased, from Messrs. Brown Bros., of New York, London, etc., a draft on the London department of that banking house, having a face value of £61. 11s. 3d. The draft is made payable to Mr. W. H. Bennett, Secretary of the home branch of the Hartley fund. The sum sent guarantees to the beneficiaries the reception of the entire amount collected ($300) on this side of the Atlantic through our efforts and your kindness. The expenses of transmission—of course these were but slight—were undertaken by Messrs. A. M. Callender & Co.

ANNUAL MEETING OF THE PARENT ASSOCIATION.

Secretary C. H. Nettleton paid us a visit the other morning, during a hurried business trip of his to our vicinity, and he spoke with great confidence as to the assured success of the 16th annual meeting of the pioneer body of Gas Engineers of this country—the New England Association. Bright and useful memories cling to its past records; and increasing years but serve to amplify its value and vigor.

WE are in receipt of a letter from Mr. Kitson, of Phila., Pa., the publication of which is unavoidably delayed until issue for March 2d.

Proceedings of the Society of Gas Lighting.

ANNUAL ADDRESS OF PRESIDENT.

At the annual meeting of the Society of Gas Lighting (December, 1885) the President, Jos. R. Thomas, C.E., delivered the following address:

"Time runs its ceaseless course," and its rapid flight once again carries us to the day set apart for the annual meeting of this Society. To-day we once more assemble to fulfill the duties appertaining to that event, and also to prepare for the advent of the tasks allotted for 1886. It will not seem inappropriate, then, to here rapidly glance over what has been done during the twelvemonth in the effort to promote the work of this Association. By such retrospective view we can best estimate the benefits that have accrued to us through our monthly assemblies, and thus lead ourselves on to arrive at a just conclusion regarding the value of our efforts to advance the progress of our industry, and the increase gained by our attempts to establish that business (which we are here to represent in our best individual capacities) on an ever increasing dimension of sound and solid basis.

It gives me unalloyed pleasure to state that the business of gas manufacture has made steady progress throughout our entire country during the past year; and this gratifying state of affairs has been brought about, in great measure, by the reductions granted in the matter of selling prices. It needs but slight perception to determine that these reductions have proved most acceptable and satisfactory to the consumers of our product; and they in turn have rewarded the concessionists by liberally increased employment of gas. The low selling rates that now almost universally prevail must, in the near future, still more urgently tell in the direction of an increased send-out, thus adding a safe block, of huge size and strength, to the "dimension of basis." To the weak ones I would say, an increased demand for gas has invariably followed a reduction in its price, and that such increase will speedily recoup any shrinkage in receipts originally occasioned by any moderate concession. In fact, I may claim that to be a self-evident fact; for its reliability has been proved whenever and wherever attempted.

The papers (given in the order of their presentation) read before the Society during the year were the following:

"Proportion of Storage Capacity to Consumption," by F. S. Benson.
"Different Processes of Manufacturing Water Gas," by F. C. Sherman.
"Coke Breaking for Domestic Use," by C. H. Nettleton.
"Retort House Chimneys," by E. Vanderpool.
"Value of Tar as an Enricher," by J. R. Thomas.
"McIlhenny's System of Furnaces," by J. H. Armington.
"Advantages of Three-Hour Charging," by A. B. Slater.
"Contracts for Purchase of Tar," by J. H. Armington.
"Presence and Amount of Ammonia in Gas," by A. M. Smith.

Although the number of papers presented was much smaller than we had reason to expect or anticipate, still we should feel thankful that some of our members responded to the call made upon them. I can further add that the papers submitted have furnished interesting matter, and have been the means of affording a starting point for discussions freighted with valuable and important hints to the gas maker.

To make a slight reference to a few of the topics handled by the contributors, I may say that the question of the relative proportion of storage capacity to consumption is one of great moment to gas engineers. It is regrettable to note the frequency with which we find cases where the storage capacity is all too narrow when placed in comparison with the maximum send-out. You need not be told (under such "penny wise pound foolish" policy) at what disadvantage an engineer is placed, and how hampered and harassed he must be—since it can only be by reason of the utmost vigilance and unceasing exertion that he can furnish the gas demands of his company's patrons. I have always believed that an engineer should not be forced to enter the ranks of "night watchmen;" and to prevent such enforced service, and to guard against inconveniencing the consumers as well, I hold that, under any circumstances, the maximum storage capacity of a plant should exceed the daily send-out of that plant by at least 50 per cent. I hold to that opinion all the more strongly since I believe that companies so equipped will find that ratio of "holder investment" in line with true economy.

The paper on the different processes for manufacturing water gas would seem to carry the conviction that it will be best to leave all such processes severely alone. Indeed, such decision is likely to follow in every case where the merits of this gas are judged by the standard of intrinsic merit and economy. As to the question of comparative safety between the two illuminants—coal gas needs neither explainer nor defender.

One of the most important papers read was that which dealt with the practice of burning off the charges in retorts in three hours. This, in fact, means a radical revolution from the four-hour plan now almost the universal practice in this country. If this three-hour theory can be successfully maintained by a general practical exposition (we have every reason, too, for the

belief that the experimenter has stood and now stands on solid ground in this respect) a great stride in advance will have been secured in the art of gas manufacture. What is the actual gain accomplished? Simple of estimation (plain to anyone) I think it to be. A successful following out of the three-hour carbonization plan will secure an increase in capacity of manufacturing plant of fully 33 per cent. over the four-hour practice. This item bids fair to open up a new era in the practical economy of gas making, and its importance will no doubt gain for it that careful study which should be bestowed upon it.

The past year has differed but little from its predecessors in the matter of the efforts made by so-called competitors in the field of gas supply. The desire to raid on established companies exists as strong now as it did before in the "minds and hearts" of a certain set of noble (?) philanthropists, who are ever ready to attempt to ruin any existing company's business, if they cannot succeed in an initial scheme of blackmail, or a fraudulent deprivation of the rights of original investment. Such things should not be tolerated among the people of a land supposed to be governed by principles emanating from a love of liberty; nor would these things, of which you have just cause of complaint, be successfully prosecuted were you to crush out the persecutors by proper and united effort. It is high time to determine upon the course to be pursued in stamping out this systematic robbery. To my mind the desired consummation can most speedily and certainly be gained by concert of action and combination of interest on the part of the persecuted. Complete and perfect an organization in every State of the Union; concert measures of relief and protection for your investments, honestly made; appeal to your legislatures to enact the measures into laws; and by every fair and equitable means secure the appointment of commissions, the members whereof shall have the power to decide when and under what circumstances newcomers shall be permitted to invade the territory you are supplying with gas light. Accomplish this once and you will not (as undoubtedly you now are) longer be at the mercy of any maurauding clique.

Lighting by electricity has made some show of progress in this country during the past year—*i. e.*, progress in the matter of street lighting. At the same time the impression pretty generally prevails that the extensions have been gained without a corresponding increase in the matter of profit accruing to those interested in the development of the business. In the city of New York, on the first day of December, the city was maintaining an aggregate number of 703 public arc lights, at an annual cost of $179,616.50. These 703 arcs have displaced 3,210 gas lights, which would have cost the city a total annual sum of $56,175. The entire number of arc lights, as called for by resolution of Board of Aldermen (passed at divers times within the year, but not yet ordered by the Gas Commission) foots up 2,062, at an estimated total annual cost of $526,841. These 2,062 arcs would displace 5,135 gas lights, which could be and are maintained at a yearly charge of $89,862.50—showing a difference in cost of the arc lights over gas lights of $436,978.50 per annum. This sum would pay for the maintenance of 30,100 gas lamps equipped with size of burner equal to that now in general use over the city; or would suffice for not less than 18,000 lamps each equipped with burners rated to consume 6 cubic feet per hour. From the baldness of the figures given it should be readily determined which description of light should prevail. And I would not have it understood that some of the New York city gas light companies are over anxious to increase their present holdings of municipal favor (in the direction of street lighting—or, for that matter, in any other department either), at the price which is paid for same. In other words, it would be in accord with sound business policy were the Equitable Gas Light Company allowed to supply the city's street lights at a uniform price of $12 per post per annum.

At any rate, the claim made that the "light of the future (in *its present* embryo state) requires proper and "extensive coddling" for its future development may, after a manner, be accepted by those not pecuniarily interested in the settlement of New York city's public lighting "bills rendered." Still, I fear that the taxpayers may be inclined to view the "nursing" process through glasses of an entirely different grade; and possibly the taxpayers may be forgiven for failing to understand why the "arc system" should be "coddled" at their expense.

Many other interesting topics could be brought to your notice, but I have merely sought to attract your attention to what I consider to be "main features;" and, in conclusion, I beg to remind you that, with the coming year, we must bring renewed vigor to our work—the improvement and perfection of the manufacture and distribution of illuminating gas. Where the "will" to do exists, there also can we find the "way" to accomplish that which we desire. Persistency, excusable and honorable when properly directed to secure the achievement of advance, will enable us to accomplish a victory in that which we deem to be proper and right.

THE NEW GAS WORKS AT ALPENA, MICH.—Mr. Peter DeMill, Jr., has kept his word to the residents of Alpena, gas having been supplied them for the first time on Jan. 19, '86. The franchise was not granted until June 1, '85. The proprietors have an exclusive contract for a period of ten years. Extended mention of Mr. DeMill's enterprise will appear in our next issue.

A Synopsis of a Year's Progress in the Manufacture of Illuminating Gas in the United States, as Indicated by the Files of the Patent Office—With an Example.

By FREDERIC EGNER.

Estimating the strides taken, or progress made, in the art of gas making during the year 1885 through the actual light of known results, it will speedily be determined that no real advance has been achieved. But, on the other hand, if we were to gauge the measure of progress by a standard adjusted in accordance with the idea that the total number of patents issued, for alleged improvements in processes and apparatus for the manufacture and distribution of illuminating gas, represented substantial gain in our business, then indeed might it be truthfully claimed that the year just ended was far more prolific than was any of its predecessors. In passing, it might also be added that the new year, judged from the fecundity shown by its first few weeks, gives promise of an even greater total of "births at the patent office."

As nearly as the writer can classify the published inventories of the past twelve months, it is seen that patents covering 26 "regular" (or pure and simple) water gas, 18 "coal, oil, steam, and air gas," 12 "natural and oil gas," 26 "air and oil gas," and one "sawdust and oil gas" processes and apparatus were issued. Twenty-four patents were issued for improved appliances—such as scrubbers, retort lids, purifiers, and purifying mixtures, tar (and other) valves or gates; also, one charging machine.

The more extensive development, and consequent increased use, of natural gas is alone responsible for 76 different patents—variously accredited to pipe systems for carrying the gas under heavy pressures, and under no pressure at all; for the detection of leaks, and for conveying to safe outlets the gas escapes from such leaks; for reliable main joints and pipe couplings; for different valves, and so on. Indeed, after an inspection of the most cursory nature, one cannot help but be impressed by the ingenuity displayed by some of the explorers or inventors in the patent field included under the classification above allotted to "natural gas." Moreover, in view of the improvements made in the matter of conducting gas currents under long stretches of ground—uphill and downhill, under bridges and rivers—the scheme of distilling gas in plants located at the mouths of the coal pits, and "piping" the currents to the thickly populated centers of industry and residence, does not seem now a tithe as chimerical as was the case a dozen years ago. In fact, the only cogent reasons to be urged against the scheme are pure military ones; and which will immediately force themselves on those who will bestow a moment's serious consideration upon the topic. Still, the seeming great advantages, certain to be obtained during times of peace, are more than likely calculated to outweigh the disadvantageous reasons that might be advanced as to problematical losses consequent upon the uncertainty of war; and it need occasion no surprise to see capital—always active after lengthy, profitable, and reasonably sure investment—taking up this subject at an early date.

To describe the various processes lumped above in numerical aggregate, even did we adopt the concise terms or language of the patent specifications, would fill many numbers of the JOURNAL; and in consequence the interested reader must be referred to the files of the Patent Office for such information; while if the "merits" of each invention—that is, as the inventor sees them—were to be descanted upon, justice could scarcely be arrived at even were volumes written thereon.

As to how many of these inventions were ever demonstrated by actual operation, it would indeed be difficult to say. Even "practical experiments" are not unlikely to mislead an enthusiastic inventor, though a disinterested party would not be so easily blinded or led astray. And here is where the example remains to be exemplified.

In issue of JOURNAL for October 16th, 1885, p. 206, there appeared a description of a new process, which promised to produce gas very cheap indeed. Even that most conservative of periodicals—the London *Journal of Gas Lighting*—reproduced the article in question, and bestowed a kind, though somewhat equivocal, notice upon it. Bearing all the foregoing in mind, it might possibly be supposed it is now a most unpleasant task for the writer to acknowledge that he allowed himself to be deceived; nevertheless, he not only believes it to be right and proper, but esteems it a bounden duty to publish the results of his last experiments, gained after a more extended and careful trial with the new apparatus, and which proved the previous statements and deductions to have been in error, rather than—by allowing the earlier assertions to stand uncontradicted—allow anyone to be misled.

As stated in the article referred to, the oil gas was made in three retorts which were part of a number contained in an ordinary coal gas bench. These retorts were cut off from the hydraulic main of the stack by new Ludlow valves attached over the dip-pipes. Gas was made in these retorts several days before operating them in connection with the new apparatus. When the change was made the valves were, of course, closed; but some hard tar must have adhered to the valve seats, thus preventing their tight

seating, and permitting gas to be drawn from hydraulic main of retort house, when the exhauster attached to the new machinery or apparatus was started up. These valves were tried at least twice a day, to make sure that they had not been meddled with; and they were always found—as was believed—closed. The gas apparently made in the new apparatus passed through a Farmer zig-zag scrubber, a large set of purifiers, and one of our station meters—the last being almost new, and is an elegant specimen of the work furnished by the American Meter Company.

The coal and coke were weighed, and the oil was carefully measured. When the total production varied not far from one million cubic feet the results were announced. Not until a new bench had been erected alongside of the generator (when the new apparatus was worked entirely separate from the plant in works proper) was the miscalculation discovered. Then it was determined and proved that over five gallons of naphtha—and 20 to 26 pounds of coke for fuel in the bench—together with from 12 to 14 pounds of Pittsburgh coal, were required to produce one thousand cubic feet of 20-candle gas. Fuel expended in the raising of steam is not included. In the original paper it was stated that 1.33 pounds of coke were required as fuel; but this was a "clerical error," and should have read 13.3 pounds. In all other respects, excepting real results as now explained, the apparatus was correctly described.

So far as "materials required for the production of gas" are concerned, it will be at once seen that this process is no better than—and not even as good as—several other well-known water gas processes; besides, the specific gravity of the gas, when at 20-candle power, was equal to 0.74. The apparatus (as described in the number of JOURNAL previously mentioned) produced only 96,000 to 100,000 cubic feet, instead of 150,000 cubic feet, every 24 hours. Otherwise the apparatus worked without a hitch; and one fireman could have attended to three such sets with greater ease than he could keep up the heats under five coal gas benches worked or fired with the ordinary bench furnace. If the new apparatus were to be built with a regenerator furnace, its operation would be still more greatly simplified. As a labor-saving operation the apparatus in question can be considered a success, since, if occasion required, one man's labor would suffice to produce 150,000 cubic feet of gas in twelve hours; but the cost of oil is always a great drawback to this as well as to all other processes dependent upon its use.

The cost of the machine, including every appurtenance, was rather less than $2,000; and it could now be duplicated for a much smaller sum. It was operated, on one run, for nearly eleven days without a single minute's intermission; and was then stopped in consequence of clogged dip and standpipes. After cleaning these a run of seven days was made, when the process was stopped for an investigation into working order of apparatus. Examination proved that everything was in normal condition.

There can be no doubt that coal gas intelligently produced, and its residuals—coke, tar, and ammonia—tellingly handled, can be manufactured much cheaper than can gas made by the method herein mentioned. All that can be said in favor of the new apparatus is, owing to its simplicity and ready applicability in existing coal gas works, it would be a very efficient substitute and able auxiliary in case of labor troubles, or when an extra heavy draught was made on the resources of a plant. However, from what has now been stated, practical men can make their own deductions. *That* was one of the processes patented during the past year; and, as shown, it was not much of a one after all. It is to be hoped that the others are better; but if a judgment may be founded as the result of an inspection of the patent drawings, and a digestion of the patent specifications, then others besides the inventor of the "Standard Process" are doomed to sad disappointments.

The year 1886 can show to date three new processes—covered by six patents—for the manufacture of illuminating gas. One of these proposes to use lime, as the decomposing and fixing medium, in externally heated retorts. That would reduce the carbonic oxide greatly below the limit now found in gas manufactured under the ordinary run of water gas systems. Another proposes to set coal gas retorts into the usual firing chamber of the orthodox (if that expression may be fairly employed) water gas apparatus. In these gas coal is to be first carbonized, and the resultant coke is to be pushed back and down into the generator. It is not the first time that that idea has been patented—if not tried; only in this last plan the scheme is made to appear a little more feasible than was the case with the others. Several "inventions" are heralded to be given to the public at an early date, with the promise that they will surely "revolutionize" gas making; but as this particular inventor claims to know all about each process that has ever been brought out, gas makers may generally look for —— as the result of the coming birth. Two new carburetors—*a la* albo-carbon light—were patented in the first week of the year; and two others, for general purposes, as well. One new system of gas mains has been added to the already long list of such schemes.

Perhaps the year 1886 may see the birth of the real "Process of the Future;" but meanwhile it seems well to "go slow" in accepting new theories, however plausible—as this article may, to some extent, tend to prove.

Testing Scrubbed Gas, Spent Lime, and Liquor for Sulphuretted Hydrogen and Carbonic Acid.

Mr. C. W. Folkard, Assoc. Mem., Royal School of Mines, furnished the following interesting communication to a recent issue of the *Journal of Gas Lighting:*

As a supplement to the well known orthodox methods of volumetric analysis recently described in the *Journal* by Mr. Norton H. Humphrys, I propose to give an account of one or two processes which have stood the test of some years' daily use in gas works; being at the same time sufficiently accurate for practical purposes, and also easy of manipulation. I find that our foremen prefer to make a rough daily determination of the amount of sulphuretted hydrogen at the inlet and outlet of each purifier, as it gives them warning should any sudden increase in the quantity of this impurity take place. There is also another advantage; for as soon as the first purifier ceases to absorb sulphuretted hydrogen, as shown by the daily tests, it can be shut off—thus lessening the work of the exhauster; whereas, in general, the first purifier is not shut off until a freshly-charged one is put on.

The apparatus required for this purpose is shown in fig. 1. It is very simple, consisting of a glass tube permanently closed at one end by a cork. It is about ¾-inch internal diameter and 5 inches long, and has a capacity of 60 septems. This serves to hold the sample of gas to be tested; being filled by displacement by holding it (open end downwards) over a lamp-cock furnished with a piece of india-rubber tube 3 or 4 inches long, to conduct the gas to be tested to the closed top end of the ¾-inch tube (hereafter called the gas tube.)

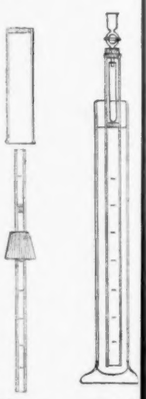

FIG. 1. FIG. 2

When the sample of gas has been thus collected the gas tube is closed by a second cork, through which passes a glass tube about 10 inches long and ¼-inch internal diameter, filled with a solution of iodine of known strength. The sample of gas being thus enclosed with the iodine solution, the gas tube and iodine tube are well shaken for (say) half a minute, by which means all the sulphuretted hydrogen in the gas is destroyed, provided enough iodine solution was taken. To ascertain this, a slip of lead paper is inserted in the gas tube after shaking, by partially drawing out the cork. If the paper is blackened, more iodine solution is put in the iodine tube, and a fresh sample of gas taken and the test repeated. If the lead paper is not discolored, less iodine is taken and a fresh trial made; and so on, until a sufficiently close approximation is obtained. From the amount of iodine solution required to *just* destroy all the sulphuretted hydrogen the percentage of this impurity is inferred.

It only remains to state that the amount of iodine solution taken for each test can be varied by altering the position of a sliding plug in the iodine tube. The small cylinder of cork removed by a cork-borer in making a hole constitutes the best plug for the iodine tube, which is graduated into divisions of a capacity of 1 septem each. The iodine solution is made of such strength that each septem required to destroy the sulphuretted hydrogen in the gas represents 0.1 per cent. by volume of sulphuretted hydrogen in the sample tested. It is made as follows:

10 grains (accurately weighed) of pure, dry bichromate of potash.
80 " (a few grains more or less are immaterial) of iodide of potassium.
40 septems (a few septems more or less are immaterial) of pure, strong hydrochloric acid.

Dissolve the two first in water; put in a decigallon test mixer (taking care not to lose any); add the acid; fill up to the mark with ordinary tap water and keep in a well-stoppered bottle, or the liberated iodine will escape. This solution is of such strength that if 10 septems of it are just sufficient to destroy the sulphuretted hydrogen in 10 septems of gas, the gas contains 1 per cent. by volume of sulphuretted hydrogen. This stock solution is to be diluted with water to such an extent that 1 septem indicates 0.1 per cent. of sulphuretted hydrogen in the sample of gas taken for analysis.

This apparatus serves to determine 0.1 to 2 per cent. of sulphuretted hydrogen (*i. e.*, scrubbed gas), which, in the latter case, is a difficult matter with the Harcourt color test.

For gas containing only some few hundredths of a per cent. of sulphuretted hydrogen the same method is used, except that the gas tube is made larger, or is replaced by a white glass bottle of the capacity of about 20 septems, the necessary strength of the iodine solution being calculated in the usual way; so that one division on the iodine tube represents 0.005 per cent. of sulphuretted hydrogen. By this means the gas at the outlet of the sulphides (containing usually 0.05 per cent.), and that at the outlet of the first catch purifier (containing usually 0.005 per cent. of sulphuretted hydrogen) can be analyzed. The gas at the inlet of six or eight purifiers of

thus be analyzed for sulphuretted hydrogen in about half an hour, and a daily record of the work done by each purifier is obtained. By this means any irregularity of working caused by careless charging of the material or by blow-holes, etc., is at once detected, as well as any sudden rise in the amount of sulphuretted hydrogen in the scrubbed gas, due to pyritous coal, etc. Occasionally the rise has been from 1 to 2 per cent. (*i. e.*, double the quantity) in 48 hours; and when this occurs it is time to see that the revivification of the oxide from the last purifier is pushed on as rapidly as possible. A quantitative test for carbonic acid as simple and expeditious as the above is a *desideratum*.

To ascertain that the ammonia is removing the proper quantity of carbonic acid and sulphuretted hydrogen from the crude gas is a matter of some importance, inasmuch as the cost of purification is thereby reduced to a minimum. By the aid of the apparatus shown in fig. 2 this can be done with sufficient accuracy in less than five minutes: A glass tube, open at both ends, 24 inches long, ¾-inch internal diameter, and graduated into septems, is divided into two parts by a cork pierced with a hole. This cork serves as a platform to carry a small test-tube containing 5 septems of the liquor to be tested, which is thus enclosed in the 24-inch tube. A cork, through which passes the tube of a glass funnel provided with a stopcock, closes the upper end of the long tube; the funnel serving to hold the acid required to liberate the gases contained in the liquor. The 24-inch tube is immersed in water contained in a cylinder about 21 inches in length.

Fig. 2.

To make a test: measure off 5 septems of the liquor by means of a pipette, and transfer it to the test-tube standing on its cork platform inside the long tube. Insert the cork carrying the stoppered glass funnel in the tube, and depress the latter in the water contained in the cylinder (the stopcock being open) until the water rises inside the tube exactly up to the under side of the perforated cork platform. Shut the stopcock, and measure into the funnel 3 septems of strong hydrochloric acid. Open the stopcock a little, and allow one drop of the acid to fall into the test-tube. Carbonic acid and sulphuretted hydrogen will be evolved, and will force down the water in the tube, which must then be raised so as to maintain the water at or about the same level inside and out. More acid is admitted, drop by drop (to avoid loss of the liquor from the test-tube by effervescence), till very nearly all has run in, by which time no more gas will be evolved. It then only remains to read off the number of septems of gas liberated.

To give an actual result, 5 septems of 8-ounce liquor (acid test) gave 50 septems of gases evolved. As the residual weak chloride of ammonium solution retains more than its own bulk of gases, and the water in the cylinder also absorbs a little, if we add double this bulk—viz., 5 septems of liquor + 3 septems of acid = 8 septems × 2 = 16 septems of carbonic acid and sulphuretted hydrogen—we shall not be far from the truth. So, 5 septems of the 8-ounce liquor contain 50 + 16 = 66 septems of dissolved gases = 13.2 times its bulk. A regular analysis of the liquor, estimating the sulphuretted hydrogen by copper solution, and the carbonic acid as carbonate of barium, gave 9.9 volumes of carbonic acid and 3.8 volumes of sulphuretted hydrogen—or 13.7 volumes of mixed gases, as against 13.2 volumes by measurement of the evolved gases. To form *neutral* carbonate of sulphide, the "free" ammonia of 8-ounce liquor would absorb 11.2 volumes. This shows that, when scrubbers or washers are properly worked, the ammonia absorbs from the gas more than a single equivalent of carbonic acid and sulpuretted hydrogen, with the probable formation of acid salts to the extent of 20 per cent. or thereabouts; thereby decreasing the amount of lime or oxide required for purification. The 8-ounce liquor above mentioned had removed 0.51 volume of carbonic acid and 0.20 volume of sulphuretted hydrogen from 100 volumes of the crude gas; leaving 0.9 and 1 volume of each respectively to be removed by the purifiers. It is thus evident that 60 per cent. more lime, and 20 per cent. more oxide, would have been required, but for the absorbing power of the ammonia; and, consequently, analyses of liquor should be made regularly, to ascertain that the ammonia is doing its fair share of the work of purification.

It should be noted that the combining volumes of sulphuretted hydrogen and carbonic acid are the same; so that a given quantity of ammonia will combine with 10 cubic feet of carbonic acid, or 10 cubic feet of sulphuretted hydrogen, or 5 cubic feet of each. If necessary, the sulphuretted hydrogen may be absorbed by adding a small quantity of solution of bichromate of potash to the gas liquor, by which means only the carbonic acid will be evolved by the acid.

The simple apparatus just described is also available for determining the amount of carbonic acid in spent lime, etc. A partial analysis, sufficiently accurate for practical purposes, can be rapidly made as follows: Powder finely about 200 grains of the sample; weigh in a clock glass 100 grains, and place in a water oven till it ceases to lose weight. The loss gives the moisture. Exactly 1 grain (weighed on a chemical balance) of the moist spent lime is put in the test-tube in which the ammoniacal liquor was placed, and the number of septems of carbonic acid gas evolved by slowly dropping in the strong hydrochloric acid is measured in exactly the same way as for the analysis of liquor. To take an actual result—100 grains of moist carbonate lost 32.7 grains in the water oven, = 32.7 per cent. of water; 1 grain of moist carbonate gave 20 septems of carbonic acid gas. Adding two septems (for that dissolved in the 1 septem of hydrochloric acid used to liberate the gas) gives 22 septems of carbonic acid. Each septem is equivalent to 0.0295 grain of carbonate of lime; 0.0295 × 22 = 0.649 grain, or 64.9 per cent. of carbonate. Adding together the water and carbonate, 32.7 + 64.9 = 97.6 per cent. This leaves 2.4 per cent. only for the unaltered lime and impurities.

If it be desired to estimate the amount of unaltered lime directly, the well known method with solution of chloride of ammonium may be employed thus: 100 grains of the finely powdered undried sample are placed in a conical flask, holding 8 or 10 oz. when filled to a mark in the neck, with about 1 oz. (about 60 septems) of a saturated solution of chloride of ammonium. The flask is filled with water up to the mark, corked, and left for an hour or two, occasionally shaking. It is then allowed to settle till it is quite clear, and half the total quantity of solution—viz., 4 or 5 oz.—is poured off carefully to avoid disturbing the sediment. (If sufficient time cannot be allowed for settling the liquor may be filtered; but if there is much free lime in the sample some of the liberated ammonia may be lost during filtration.) The 4 or 5 oz. of clear solution will turn red litmus paper blue; and all that is necessary is to ascertain how many septems of 10 per cent. acid (the same as is used for testing liquor) are required to make it neutral to litmus paper.

In the case of the sample of carbonate above mentioned, 1.6 septems of 10 per cent. acid were required for half of the solution = 3.2 septems for the whole; 3.2 × 0.54 = 1.7 per cent. of unaltered hydrate or slaked lime. The composition of the spent lime was, therefore, as follows:

	Per cent.
Water	32.7
Carbonate	64.9
Hydrate	1.7
Impurities and loss	0.7
	100.0

As 100 parts of carbonate represent 74 parts of original hydrate, the 64.9 per cent. of carbonate equals 48 per cent. of original slaked lime. The unaltered slaked lime was 1.7 per cent.; or a total of 48.0 + 1.7 = 49.7, of which 48 per cent. was converted into carbonate. Then—

$$49.7 : 48.0 :: 100 : x.$$

$x = 96$ per cent. of the original lime converted into carbonate.

Another sample, in which the lime had (as an experiment) been charged in a layer 12 inches instead of 6 inches deep, gave the following results: 100 grains gave 42.4 grains of water and 57.6 grains of dry material, of which we may assume that 55 grains were carbonate and hydrate of lime, the rest being impurities. 100 grains treated with chloride of ammonium required 17.6 septems of 10 per cent. acid to neutralize the ammonia liberated by the uncarbonated lime. 17.6 × 0.54 = 9.5 per cent. of unaltered hydrate. 55 − 9.5 = 45.5 per cent. of carbonate of lime in the sample, equal to 33.6 per cent. of hydrate turned into carbonate. The composition was, therefore, as follows:

	Per Cent.
Water	42.4
Impurities (say)	2.6
Carbonate	45.5 = 33.6 of hydrate.
Hydrate	9.5
	100.0

$$(33.6 + 9.5) : 9.5 :: 100 : x$$

$x = 22$ per cent of the original lime uncarbonated.

In the above methods there is no pretence to scientific accuracy; and, indeed, the purifying house is not the place for costly and fragile instruments such as burettes, etc. At the same time, everyone will admit the advantage of being able to ascertain in five minutes what work a particular purifier is doing, and this is, of course, quite impossible with lead paper, as 0.03 per cent., or less, of sulphuretted hydrogen gives as black a test as 1 or 2 per cent. The form of the instrument described is the one which has stood the test of practical daily use, although at first two solutions were employed—viz., standard iodine in excess, to destroy the sulphuretted hydrogen; the excess of iodine being determined by standard hyposulphite of soda run in from a burette. But the burettes did not last long; and the hyposulphite was finally abandoned.*

The quantity of carbonic acid can be inferred by the time required to render baryta water milky. The gas freed from sulphuretted hydrogen is bubbled at the rate of 3 cubic feet per hour through a tube containing 2 oz. of baryta water. I find that 0.01 per cent. by volume of carbonic acid will

* I may perhaps be permitted to state that the instruments and solution ready for use can be obtained of Messrs. Alex. Wright & Co., Millbank street, Westminster.

turn the baryta milky in half an hour. Of course, this seems a very small quantity; and many bye-pass valves would leak enough to account for this. But if we consider that 0.01 per cent. of carbonic acid is chemically equivalent to about 13 grains of "sulphur" per 100 cubic feet, we shall recognize the importance of absolutely gas-tight bye-passes for carbonates as well as for catch purifiers. Hydraulic or twin-slide valves (not double-faced valves) are the only ones which fulfil this condition of permanent tightness. In fact, no one who has experienced the satisfaction of knowing that his bye-pass valves *cannot* leak under any circumstances, would willingly revert to the old single-slide gas valve, which may be tight when new, but which, of course, is liable to leak at any time through dirt getting on the face, broken springs, etc.; such leakage being only found out by the "sulphur" going up, or by dirty gas passing into the holders—in other words, when the mischief has been done.

Mr. F. J. Rowan on Gas Producers.

The following is an abstract of a paper read by the author (Mr. F. J. Rowan) before the eighth ordinary meeting of the English Institution of Civil Engineers, on date of Tuesday, Jan. 12. Mr. Rowan held that the large degree of favor in which the use of gaseous fuel was now held among those connected with manufacturing operations was undoubtedly due, in great part, to the labors of the late Sir William Siemens. Yet, as compared with the practice of twenty years ago, it was still far short of a universal adoption of the system of gas firing; but it might be predicted that, as the subject became more widely understood, the examples of any other method of treating fuel would become few and exceptional. The use of gaseous fuel resulted naturally from a clear perception of the principles of combustion. It was readily seen that the first stage in the combustion of all ordinary fuels was their conversion, in large measure, from the solid or liquid into the gaseous form, and that it was only when they reached this stage that their value for heating purposes could be properly realized. The distilling and vaporizing processes involved in that conversion absorbed heat, and their character thus pointed to their being separated from subsequent heat-producing operations. When they were carried on in the same chamber in which the resulting gases were burned, the maximum temperature attained was, as might be expected, much lower than that attainable by other means. There were also sources of loss of heat inseparable from the direct use of solid fuel, such as imperfect combustion, the impossibility of minimizing the quantity of air introduced for combustion on account of the complexity and constant variation in the operations involved, radiation from solid residue, etc.—all of which intensified that result. The actual conditions of combustion and the extent of the various losses, in quantity of heat, occurring in coal-fired furnaces had been formulated by Rankine, Minary, Schwackhöfer, and others; while Robert Galloway had directed attention to the difference in temperature, or calorific intensity, obtained when carbon was burned in air, and when carbonic oxide was so burned. It appeared that a higher calorific intensity might be obtained with the gaseous fuel, chiefly on account of the smaller quantity of air required for combustion, and as a consequence the much lessened dilution of the heat by inert nitrogen and carbonic acid. The investigations of the late Dr. Grouven, of Leipsic, of Mr. Wm. Foster, and of others, by directing attention to the nitrogen contained in coal, and to the large proportion remaining in coke and recoverable therefrom, had added to the advantages of the use of gaseous fuel the important consideration of the value of bye-products which might be associated with its production. If any of the nitrogen existing in coal was to be recovered as ammonia, the employment of gas producers of some sort became a necessity.

In the production of gas from coal and coke the following classes of apparatus had been devised and used:

1. Retorts, heated externally, for distilling the hydrocarbons from coal apart from contact with air; coke, as a refuse material, being withdrawn periodically. This was the ordinary form of plant in use in gas works.

2. Generators, or producers, in which coal was consumed or converted into gas by combustion with access of air. The hydrocarbons were distilled in these appliances by means of the heat conducted or radiated from the zone of combustion, and the coke or fixed carbon was burned with air first to carbonic acid, which was thereafter reduced to carbonic oxide by contact with the incandescent carbon.

3. Producers, in which the same result was arrived at, with the modification in the composition of the resulting gas due to admixture of steam with the air supply.

In the two latter classes the producers might have either a grate with bars or a closed hearth, and might consist of one or of two chambers; in the latter case the distilling chamber might be heated partially or entirely from flues or passages on the outside. The resulting gas was of the same composition in both cases, and must contain from 30 to about 60 per cent. by volume of nitrogen derived from the air introduced for combustion.

In one form of the apparatus of class 3 (namely, Young and Beilby's) steam was used in excess, while the combustion of the coke was maintained at a comparatively low heat; as the primary purpose of this apparatus was not the production of good heating gas, but the securing of the nitrogen of the fuel as ammonia.

4. Apparatus in which incandescent coke or anthracite was used to decompose steam for the production of "water gas," either continuously, by the use of retorts heated from the outside, which contained the carbon in contact with which steam was decomposed; or intermittently, by the use of generating chambers in which the carbon was first brought to a state of bright incandescence by an air blast, and into which, secondly, steam was passed through the carbon, the air blast being shut off; or the heat produced by the combustion of the carbon, or of gases from the generating chamber, was, in the first instance, stored up in brickwork, which, being made white hot, was then used to decompose steam.

5. The writer had recently proposed an apparatus combining the retort system of distilling the hydrocarbons from coal, with means for consuming the resulting coke or fixed carbon in an atmosphere of steam only, excluding air and applying a sufficiently high temperature to prevent or minimize the formation of carbonic acid, the whole working together continuously and automatically.

The practical value of any example of these various classes depended upon the quality of the gas produced and the cost of production, a rough practical test of the efficiency of a gas producer being afforded by the percentage of carbonic acid and nitrogen contained in the gas, and the volume of gas of a given temperature produced per ton of coal. An exception was made in such special apparatus as that of Young and Beilby, which must be tested by the yield of ammonia obtained per ton of coal.

A table containing, it was believed, all the trustworthy analyses of producer gases available, was given in an appendix. These analyses showed that the gas from producers worked by internal combustion did not contain more than 45 per cent. (but as low sometimes as 26 per cent.) of combustible ingredients, having, according to the various authorities, a theoretical calorific intensity of from 1,575° to about 2,200° C. Water gas, made either by means of retorts or of intermittent apparatus, and ordinary illuminating gas made by distilling coal, contained from 86 to 97 per cent. of combustible matter, with corresponding possibilities of producing high temperatures. Illuminating gas had, however, a higher calorific value than ordinary water gas, but not higher than the gas made in the apparatus of Lowe and Strong.

The investigation of thermo-chemical data, connected with the question of the economical working of producers, did not enter into the scope of the paper; but the advantage of using steam along with the air supply in internal combustion producers might be referred to. Mr. R. Schöffel had calculated, on the supposition that producers were worked at a minimum temperature of 1,200°, that 85 parts of carbon were gasified by air when 12 parts were gasified by steam, and that 18.5 parts of steam were required for 100 parts of carbon. Mr. A. Wilson had shown that the mixture to produce 100 parts by weight of gas was, roughly, coal, 17.5; air, 79.9; and steam, 4.0; or that 100 parts of coal required 22 of steam. Allowing for the difference between coal and carbon, Schöffel's calculation was practically in accordance with Wilson's. It was, however, probable that in the future efforts would be directed toward the perfection of means of producing gas free from the dilution of the large quantity of nitrogen derived from an air supply, as this system not only afforded the means of obtaining high temperatures of combustion, but also tended to simplify furnace arrangements, rendering it necessary to heat the air only prior to combustion in them, and not, as at present, both air and gas.

The historical portion of the subject embraced the various steps in the introduction of gaseous fuel; the numerous attempts to manufacture it according to the information possessed at the time, and the experience thus gained; and the different designs of producers, with the influence of the introduction of suitable furnaces for the use of gas upon these designs. The employment of waste gases from iron furnaces and from various metallurgical operations was clearly the first movement in this direction.

The author then proceeded to describe, in detail, the gas producers of Bischof, Ebelmen, Ekman, Beaufumé, and Siemens—the latter being an outcome of the regenerative furnace. Lundin and Bérard added apparatus to producers for washing the gas; and descriptions were given of the Benson producer, and those of Minary, Wittenström, and Kidd. The processes of Lowe and Strong for illuminating and for heating gas were then referred to, followed by notices of the producers of Tessié du Motay, Wilson, Dowson, Gröbe and Lürman, Sutherland, a modified Siemens producer of the old type, Howson, and the apparatus of Young and Beilby, which was devised primarily to recover as ammonia the nitrogen in shale and coal. The paper concluded with an account of what had been done in the way of recovering ammonia and tar from producer gases.

The business address and publication offices of *Iron Age* have been changed to Nos. 66 and 68 Duane street, this city.

On Explosive Gaseous Mixtures.

MM. Berthelot and Viele's latest researches on the subject of explosive gaseous mixtures are detailed in *Annales de Chimie et Physique*. An abstract of report, as published in the record above noted, goes to show that their experiments were made to determine the pressure developed and the heat generated by the explosion of various gaseous mixtures in closed vessels. Tables of results are given, and from them the authors deduce the limits of temperatures of combustion, dissociation and the specific heats of the gases at very high temperatures. The results, methods of experiment and calculation are discussed in eight papers.

1*st. On the Calculation of the Temperatures of Combustion, the Specific Heats and Dissociation of Explosive Mixtures.*—This paper is a continuation of a memoir by M. Berthelot, in 1877, and contains a theoretical consideration of the principles which have guided the authors in these investigations.

Given the pressure P, developed by the explosion of a gaseous mixture, the temperature of combustion is determined by the method of limits. In the case of no dissociation a limit above or equal to the real temperature of combustion is given by the formula

$$t_1 = 273\left(\frac{P1}{Hg} - 1\right),$$

where H is the initial pressure at 0°, and g is the ratio of the volume occupied by the burnt products completely combined to that of the same bodies entirely dissociated. If the initial temperature be above zero, say, T, then

$$P\left(1 + \frac{T}{273}\right)$$

is used instead of P in this formula, which is deduced from the laws of Marriotte and Gay-Lussac. When there is complete dissociation and none of the products really combined, another limit, t_2, below the temperature of combustion, is found from the equation

$$t_2 = 273\left(\frac{P}{H} - 1\right).$$

The real temperature of combustion lies between these limits t_1 and t_2, which are brought much closer by the presence in the mixture of inert gases, such as nitrogen—in the case of combustion by means of air. Two sorts of systems are considered. Reversible systems, where the compounds formed by combustion can, by dissociation, be split up into the original components: such are CO_2, forming CO and O, and water vapor giving H and O. In non-reversible systems dissociation does not produce the original components. Thus a mixture of cyanogen and oxygen, on complete combustion, yields CO_2 and N, whilst dissociation tends to produce O and CO, or even free carbon. Knowing Q the quantity of heat generated by complete combustion at constant volume, another limit, t_4, intermediate between the preceding ones is calculated for reversible and a few non-reversible systems. The mean of t_1 and t_4 gives a close approximation to T, the temperature of combustion.

Then the total heat, Q, divided by the values t_1, t_2, t_4, T, gives a set of corresponding limiting values, c_1, c_2, c_4, C, of the apparent specific heats of the system at constant volume between 0° and T. The apparent specific heat includes the specific heat properly so-called, and the heat given up by the recombination of the dissociated components. The mean value C, of c_1 and c_4 represents the specific heat. This applies to such gases as CO_2 and water vapor, even when mixed with inert gases like N, or with hydrocarbons. Thus values of the specific heat at constant volume of different systems are deduced for temperatures ranging between 1,700° and 5,000° on the air thermometer.

When two elementary gases combine at constant volume without condensation, the ratio of the effective temperature t, to the temperature T, which would be produced by complete combustion, that is, t_1 T, gives the ratio of the volume of the portion really combined to the total volume, and hence determines the dissociation.

Special stress is laid on the results obtained from a group of isomeric mixtures—*i. e.*, mixtures which contain the same elements in different states of combination, but all yielding an identical mixture after combustion.

2*d Experimental Determination of the Pressures Developed in Gaseous Explosive Mixtures at the Moment of Explosion.*—The pressures have been obtained by exploding the gaseous mixtures in spherical vessels, and registering on a revolving cylinder the law of the displacement of a piston of known section and mass. Complete data of two experiments are given, with readings taken off the curves at given intervals of time during each experiment. The cooling effect of the walls of the vessels is observed by exploding the same mixture in vessels of different capacities. The results are fairly concordant with those obtained by Messrs. Bunsen, Mallard and Le Chatelier by entirely different methods, so far as the latter extended. The authors have made numerous experiments with 42 different mixtures of H, O, N, CO, CH_4, NO, cyanogen, ether, etc., and the pressures are recorded.

3*d. Relative Rate of Combustion of different Gaseous Mixtures.*—Three explosion vessels of different capacities and shapes were employed. The maximum pressure observed when a mixture of gases is exploded in a vessel at constant volume is always less than if the system retained all the heat generated by combustion, the loss of heat being due to contact with the walls of the vessel and to radiation. This difference is greater the smaller the explosive vessel, or the smaller the mass of gas with respect to the vessel, and it is also greater the slower the rate of combustion. The time required for the development of the maximum pressure is generally longer the larger the explosive chamber, and the greater the distance between the piston and the point of ignition. CO is slower than H, but for cyanogen and hydrocarbons rich in H, the time is about the same as for H alone, and agrees with the calculated velocities of the explosive waves. The velocity of translation of the molecules governs the phenomenon. Assuming that the flame reaches the piston at the moment of maximum pressure, the absolute rate of combustion is about 100 meters per second for hydrogen, 8 meters for carbon monoxide, and 70 meters for cyanogen. This is diminished by an excess of one of the combustible gases, and even more so by the presence of the burnt products. An inert gas like N retards combustion not only by lowering the temperature and thus diminishing the velocity of the molecules, but also by preventing contact between the molecules which act on one another. With a mixture of carbonic oxide and hydrogen in oxygen, each gas appears to burn separately at its own rate, the hydrogen burning before the carbon, and consequently the maximum pressure observed does not correspond with a uniform state of combustion of the system.

4*th. Influence of the Density of Explosive Gaseous Mixtures on the Pressure.*—If, in a gaseous system to which heat is communicated, the pressures vary in the same ratio as the densities, it follows, independently of all hypotheses on the laws of gases: (1) That the specific heat of the system is independent of its density, that is, of the initial pressure, and depends solely on the absolute temperature. (2) That the relative variations of the pressures at constant volume, produced by heat given to the system, is also independent of the pressure, and is a function of the temperature alone. In fact, the pressure itself varies directly as the absolute temperature, and, according to the theory of perfect gases, serves to determine it.

The authors overcame the difficulties attending direct measurements at high temperatures by two methods. One consisted in using a vessel, one part of which was maintained at the ordinary temperature in the air, and the other heated in an oil bath to about 153°, which reduced the density of the gas about a third. The second and more exact method consisted in experimenting on isomeric mixtures. From numerous experiments with isomeric mixtures, under different conditions as to density and heat generated, the observed results confirm the ordinary laws of gases.

The authors conclude that for temperatures up to 3,000° or 4,000° on the air thermometer:

(1) When a given quantity of heat is communicated to a gaseous system, the variation in the pressure of the system is proportional to its density.

(2) The specific heat of gases is sensibly independent of the density at very high temperatures as well as at zero.

(3) The pressure increases with the quantity of heat given to the system.

(4) The apparent specific heat increases with this quantity of heat.

5*th. Temperatures and Specific Heats Calculated from the Experimental Results.*—These are calculated by the methods described in the first paper, from the pressure P developed during the explosion, and the total quantity of heat, Q, generated by the complete combustion of the gaseous mixtures. The mixtures are arranged in four groups, and two tables are given for each group, containing the values obtained for the temperatures and specific heats.

6*th. Specific Heat of the Elementary Gases at very High Temperatures.*—The authors agree with Messrs. Mallard and Le Chatelier in the general conclusion, that the specific heat of gases increases with the rise of temperature, and that the simple gases have sensibly the same specific heat at all temperatures. By supposing the increase to be proportional to the temperatures between 2,800° and 4,400°, the authors deduce from their experiments the empirical formula:

$$C = 6.7 + 0.0016\ (t - 2{,}800),$$

which gives the specific molecular heat at constant volume of nitrogen, hydrogen, oxygen, and carbonic oxide. Between 0° and 200° the specific molecular heats at constant volume of these gases are about 4.8, and the authors find this number doubled in passing from 0° to 4,500°, becoming 9.8. The variation takes place at all temperatures; it is inappreciable from 0° to 200°, but increases rapidly at high temperatures. The law of increase of the mean specific heat above 1,600° is expressed by the formula:

$$4.75 + 0.0016\ (t - 1{,}600).$$

The real specific heat at constant volume—*i. e.*, the quantity of heat necessary to change the temperature 1°, is calculated by the formula:

$$4.75 + 0.0032\ (t - 1{,}600),$$

for the elementary gases at temperatures from 1,600° upwards.

The specific molecular heat at constant volume of chlorine is greater than that of the simple gases, being 6.6 between 0° and 200°; also at 1,800, the mean specific heat of hydrogen is 5.1, whilst that of chlorine is 15.3, thus approaching that of carbonic acid, which is about 18.

7th. Specific Heats of Steam and Carbonic Acid at very High Temperatures.—The mean specific heat of steam at constant volume deduced by the authors from their experiments may be expressed by the formula:

$$16.2 + 0.0019\ (t - 2{,}000),$$

where t is from 2,000° to 4,000°. The mean specific heat of steam at constant volume between 130° and 230° being 6.65, it is doubled at 2,000°, and trebled at 4,000°. The heat of formation of water continually diminishes as the temperature rises. This is partly due to the heat spent in the work of molecular separation without decomposition, and partly to the heat absorbed in decomposition or dissociation. About 3,000° dissociation would absorb at most 6,600 calories—that is, one-seventh of the heat of combustion, whilst molecular separation would absorb at least 8,600 calories, or about one-fifth of the heat of combustion at this temperature. These numbers are given with all reserve. The mean specific heat of carbonic acid at constant volume between 0° and t is given by the formula:

$$19.1 + 0.0015(t - 2{,}000),$$

where t is from 2,000° to 4,300°. As in the case of water, the results show that the heat of combustion of CO to form CO_2 diminishes with the temperature above 200°. The authors calculate that at about 4,500° the heat of combustion would be 28,000 calories, and dissociation would absorb at most 18,000 calories—that is, about two-thirds of the heat, whilst at least 22,000 calories of the heat is absorbed by intra-molecular transformation. Comparing the heat of combustion of H_2O and CO_2 at 0°, they are almost equal, being 58,700 calories and 68,000 calories respectively, whilst at 3,000° they become 26,000 and 38,000. Thus their ratio decreases as the temperature increases, and at very high temperatures the carbon tends to entirely decompose the steam.

8th. Scales of Temperatures and Molecular Weights.—The results of the previous papers are considered. Two air thermometers are compared, the scale of temperatures of one being determined by the dilatations of volume at constant pressure (or by variations of pressure at constant volume) whilst the scale on the other is determined by the quantities of heat absorbed. At very high temperatures these differ widely from one another, and from similar chlorine—or iodine thermometers, owing to the variations in the specific molecular heats which, especially in the case of chlorine, would point to changes in the ultimate molecular constitution of substances hitherto regarded as elementary.

"The Meter's Soliloquy."

I am made of tin and brass,
And I truly measure gas;
But "the public is an ass"—
And so it comes to pass
They doubt me.

When a bill exceeds the last
They swear that I am fast;
With liars I am classed;
As the brassiest of the brass
They flout me.

When the daughter sits up late
To entertain her future mate;
When Bridget, John, and Kate
Their betters imitate
And light up very brightly;

When company they invite
On a long and dreary night—
The house a blaze of light—
My wheels roll with delight;
My cubic feet run sprightly.

But when the bill comes in
They view it with chagrin,
And its figures to deny begin;
Still protesting, pass the money in
With many words profane.

Their folly surpassing belief,
I'm called a mysterious thief,
And of all other swindlers the chief.
Their abuse is painful; in brief,
All argument is vain.

Why should they doubt me so,
And venom on me throw?
I'm neither fast nor slow;
As the gas flows, so I go,
My diaphragms expanding.

My figures plain are ope' to view;
My hands revolve in circles true;
Bellows and wheels, though hid from you,
Have each their special work to do,
A good name demanding.

Lowly my lot is cast—
In the cellar my life is passed.
True I measure to the last
The stream of illuminating gas
That through me flows.

And when my days are passed,
And my wheels are stopped at last
And in the scrap-heap cast,
If I've measured *slow* or *fast*
My record shows.

Notes from the West.

By Retort.

February 8, 1886.

As predicted in my last letter the St. Louis "gas war" is ended; and the St. Louis Gas Light Company is the winner. The "war" has extended over a period of nearly four years, and was an unprecedentedly bitter one. It has permeated legislation for months, and finally culminated in a complete disorganization of the House of Delegates. In proof of that ruptured condition of the local legislative body I may state that the question of which is the Speaker (of the two "officials" now claiming to hold the position) is in the courts for settlement; and the validity of the various matters legislated upon is also undergoing the same costly scrutiny. The result of the whole matter is that the vested interests of the proprietors of the St. Louis Company are unimpaired, and they are secured in the matter of supplying gas in their old district until 1890, at a charge of $1.50 per thousand; and subsequently for a period of another 30 years at a rate of $1.25 per thousand. In the meantime the water gas manipulators have been given the territory now held by the Laclede Company; and the owners of the latter are already testing the validity of the water gas ordinance in the courts. When the "water crowd" perceived the uncertainty of their tenure they commenced purchasing all the old St. Louis stock they could possibly secure, paying good round prices therefor; but their efforts to obtain a controlling interest were thwarted by the pooling of the stock owned by those holders who believed in the value of their property. As far as the effect of the decision on the employes of the St. Louis Gas Company is concerned, they held a very neat jubilee of their own, on the afternoon of the 5th, when a delegation of workmen from the works of the company called on Mr. Soc. Newman at his office on Olive street. They were headed by Michael Carroll, and had with them the handsome solid silver tea service made specially for the display of Mermod, Jaccard & Co., at the last Exposition. Mr. Carroll, in a neat address, presented the service to Mr. Newman on behalf of the workmen employed under him. In his remarks Mr. Carroll referred to Mr. Newman's efforts to obtain cheap gas for the citizens of St. Louis, and said that in all his representations the President of the St. Louis Gas Light Company had been sincere and honest, as was shown in his report advising the company to accept the ordinance. Mr. Carroll said the workmen also desired him to express their approval of the action of Mayor Francis and other city officials in the late gas fight.

Mr. Newman replied, saying he had expected a delegation to congratulate him on the securing and acceptance of the ordinance, but the presentation was an entire surprise to him. He had been engaged in this gas war for four years, and it had been very trying on him. He was glad the trouble was over. That he was held in such esteem by his workmen was something he thought he was justified in feeling proud of. Their action in making him so elegant a gift was fully appreciated, and he wanted them to share that sentiment. But so far as the victory in the gas question was concerned, he thought that Mr. Scullin had more to do with securing it than himself or any other man.

Mr. Scullin, who, with Mr. James Campbell, the broker, was present by special invitation of the employes, said that Mr. Newman was entirely too modest in giving the credit of the victory to others instead of keeping it himself. No one had done more to bring about the success the company had met with than Mr. Newman.

The service is inscribed, "Soc. Newman, President of the St. Louis Gas Light Company, from his friends of the gas works, for his services in obtaining cheap gas for the city of St. Louis in the late gas war."

This long protracted "war" has been most demoralizing to gas companies and gas investments all over the territory adjacent to St. Louis; and now

that it is ended there will be an adjustment of matters by many boards of direction. The first evidence of this occurred Friday, the 5th, when the East St. Louis Gas Company took a step which will be greatly appreciated by the people of East St. Louis, especially those of them who use gas. Heretofore the price of gas has been $3 per 1,000 feet, and on date named the company decided to reduce the price to $2 per 1,000 feet, the reduction to date from February 1. The company now has 178 private consumers, and Mr. Ewing, the Superintendent, states that if the number of such consumers can be increased to 400 the price of gas will be still further reduced to $1.75 per 1,000 feet.

In my last letter I spoke of the many annoyances, and often serious injuries, inflicted upon our Western gas companies in the manipulation of city councils by some member or members who have "enemies to punish," or "axes to grind"—in either case, all done for self-glory and political buncombe. Since writing that, a sample case has come under my observation, which occurred at Circleville, Ohio, last week, and is about as follows. The city has both electric light and gas. Last fall the gas company underbid the electric company, securing a contract for five years, at a price netting about $1 per 1,000. After operating under this contract (a most reasonable one for the city, and a non-paying one for the gas company) the City Attorney, who is evidently very heavily charged with electricity, has discovered, in conning over his law books, that the Council had no right to make a contract ahead of the *actual money in the treasury*. The gas company apparently submits to the inevitable; and, under the assumption that the City Attorney is correct, takes it for granted that *they have no existing contract with the city*, and brings in its bill for all gas consumed (since it entered upon the fulfilment of the alleged illegal contract) at the current rates charged to regular consumers. The city will have the bill to pay; but the "subsequent proceedings" will be exceedingly interesting, for, in the meantime, the gas and electric companies have virtually consolidated, and a new contract with either will be at higher rates and prove of greater profit to the stockholders. This never-ending warfare over street lighting is driving many corporations into the combined business of furnishing gas and electric light. The universal verdict being that, while there is no money in the latter, it pays in saving very great annoyance. Several gas companies are now operating their own electric plants, while many additional ones are more or less under way. I desire to write at greater length on this subject of electric light, but will postpone such consideration until sending on another batch of "notes."

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

The Types do Injustice to the Bucyrus (Ohio) Gas Folks.—In our last issue we noted that a reduction of 50 cents per thousand cubic feet had recently been made by the proprietors of the Bucyrus Gas Light and Fuel Company, and the types further explained that such reduction created a ruling net rate of $2.50 per thousand. The former price was $2.50, and, of course, the last concession granted brings the new net figure to $2 per thousand.

An Electric Lighting Company at Kingston, N. Y.—Articles incorporating the Kingston and Rondout Schuyler Electric Lighting Company were filed during last January at the office of clerk of Ulster county. The incorporators are Messrs. G. W. Blanchard, C. H. Sewell, and S. I. Phillips, of New York; and H. W. Pope and J. E. Browne, of Elizabeth, N. J. Capital stock of corporation is placed at $30,000, divided into 3,000 shares, each of a par value of $10. The projectors say that the work of constructing a plant will be commenced at once.

New Plant for Little Falls, N. Y.—Capt. W. H. White, of this city, has just closed a contract with the Smith & Sayre Manufacturing Company, under the terms of which the contractors are to put up a new six-inch coal gas plant at Little Falls, N. Y. After close examination of the apparatus now in use there the Captain reached the conclusion that it would be more in line with economy to reconstruct than to repair. It will take about four miles of new pipe to make the distribution facilities complete; and the iron for same will be furnished by A. H. McNeal, of Burlington, N. J., and H. H. Fisher, of Allentown, Pa. It is well to bear in mind that Capt. White is now the controlling spirit in the Little Falls enterprise, and that he should think coal gas to be a "good enough" illuminating agent is, in itself, rather significant. The Capt. has had something to do with water gas, "you know."

Brooklyn, N. Y. Street Lighting.—The bids for public street lighting in Brooklyn for current year have been before the Board of Aldermen for some weeks; and, as is the usual style with that body, the policy of procrastination is being pursued. The figures in bids of different companies show slight change, if any, over those which prevailed in 1885. They are as follows:

Company.	Per post per annum.
Brooklyn	$19.80
Williamsburgh	21.75
Nassau	22.00
Citizens	22.00
Metropolitan	22.00
Peoples	22.00

The electric lighting people are anxious to furnish any desired number of their "low power" arcs at an annual charge of $182.50 each. In connection with the latter company it may be stated that the capital stock in same has been "doubled up."

Another Contract for Mr. Weber.—The firebrick materials for new stack of 16 benches of sixes, with regenerative furnace, to be put up in the extension to works of Equitable Gas Light Company, of this city, will be furnished by Mr. Adam Weber, proprietor of the Manhattan Retort Works.

Located in New Quarters.—Messrs. Connelly & Co., of New York and Pittsburgh, have changed their New York city headquarters. They will now be found at 177 Broadway. Their new office is a cozy and pleasant parlor.

Slight Fire at the Paterson (N. J.) Gas Works.—A slight fire occurred in the purifying house of the Paterson gas works on date of February 2d. It is understood that a defective centerseal was responsible for the blaze. The damage done was unimportant, although the location where the "trouble" made its appearance gave reason for much apprehension.

Rates at Morristown, N. J.—The gross price charged for gas at Morristown is $2.50 per thousand. Where consumption exceeds 5,000 cubic feet per month a discount of 10 per cent. is granted. The additions and improvements to plant have been completed, and the works are able to supply any demand that will be made upon them.

Cheaper Gas for Winchester, Va.—Mr. C. E. Hoover, Supt. of the Winchester Gas Company, gives us notice that his directors desire to be included amongst the ranks of the "reducers," and we accordingly enroll them on the minute book. The "reducing step" was resolved upon at a meeting of the board held Wednesday, Jan. 27th, when the following notice was issued: "The Board of Directors of the Winchester Gas Company have this day fixed the price of gas to consumers at the figure of $2.50 per 1,000 cubic feet, subject to a discount of 50 cents per thousand, if bills are paid within ten days from date of presentation. This reduction is to take effect from Jan. 1st, 1886." The old rate at Winchester was $3 per M., subject to a discount of 50 cents in case of prompt cash payment. The published concession now granted means a decrease in price together with an extension of time for settlement of accounts. The annual output of the company has hitherto not exceeded three millions cubic feet, and Mr. Hoover may be excused for believing that his corporation is inclined to deal with its patrons in a most liberal manner. However, it must not be forgotten that liberal treatment of consumers is about the surest way of increasing the profits of a gas company; and we will here ask Mr. Hoover if we can prevail upon him to furnish us, a twelvemonth from now, with a statement of total quantity of gas sent out in 1886? We have no hesitation in saying that the three-million figure of the past will be totally eclipsed by the showing of the future. We should add that the rate at Winchester is an all-round one—the city paying same as private consumers.

An Atlanta (Ga.) Newspaper on the Situation.—Brother Helme pursues the even tenor of his way in the matter of "dollar gas" at Atlanta, Ga., and will not listen to any of the dickering propositions that emanate from the Gate City benefactors (?), who are anxious to effect a "compromise." His unwillingness to "come to terms," and the gain in business done by the old company, acting in concert with the depression felt by the opposition concern, have reduced the managers of the latter to such desperate straits that they are madly anxious to sell gas at the price of 50 cents per thousand. As before noted in these columns, Mr. Helme paid no attention to the "cut," and somehow or another the people refuse to take the bait that has been dangled before them. In proof that such is the case we reprint the following from a recent issue of the Atlanta *Mail*, and submit that the editor thereof must be a rare bird in the garden of daily newspaperdom, in that he is able to give sound advice concerning gas matters. The *Mail* says: "A notice has been given by the new gas light company that it has reduced the price to 50 cents per thousand cubic feet. Everybody knows that gas cannot be profitably manufactured and sold at this price. Hence it is but an effort to induce people to take an inferior gas. We are glad to see that the old Atlanta Gas Company (our own company) has paid no attention to it, but goes on furnishing a superior gas at reasonable prices. People who are afraid of explosions stick to the old gas, which is safe and brilliant."

Cheaper Gas for Fort Scott, Kansas.—When Mr. L. K. Scofield purchased the plant and franchises of the Fort Scott Gas Company many said that he had made a bad investment; and they would perhaps have been successful in their prophecies had the purchaser adhered to the grab-all policy. Mr. Scofield, however, is a gas man all the way through; and, being imbued with true business principles, at once set out upon the task of reforming the conditions of the Fort Scott gas supply. He became proprietor of the plant in 1883, and at once empowered Superintendent E. W. Morse (who is in thorough accord with his principal) to reduce the selling rates from $4 to $3.50; this move was shortly afterwards followed by a reduction to $3; and now comes the news that a further concession became operative on first day of Jan., 1886, when the schedule price was fixed at $2.50. Coal, other supplies, and labor are expensive items in that portion of our country, when cost of same things in other more favored localities is given due consideration. Messrs. Scofield and Morse have no hesitation in declaring that profit has been the sequence of these repeated reductions, and propose to keep on in the same direction. In his letter to us on the matter Mr. Morse says: "Should we still continue to receive the same ratio of patronage that has been extended to us by the people of our city, in consequence of these reductions, we shall soon be enabled to whittle the price down further." The evidence furnished by the past forms the safest basis for an estimate of the future; and so we expect that Mr. Morse's knife will soon again be "caught at whittling." The Sperry Electric Lighting Company projectors have a station at Fort Scott; but so far it has received only slight support.

Settlement of the Hillsboro (Ohio) Lighting Difficulties.—The differences between the authorities and gas company at Hillsboro, as to prices that should be charged for public lighting and private consumption (alluded to in our issues for December 16, '85, and Feb. 2, '86) have been adjusted, and on the terms substantially proposed by the city's officials. In our original allusion to the matter (at that time we were not cognizant as to prices submitted by the company to the authorities) we explained that under the ten-year contract, which terminated with close of '85, the prices charged were $31.50 per lamp per annum, and $3 per thousand to private consumers, and suggested that a fair basis whereon to make a new contract would be, say, $22.50 per post per annum, and $2.10 per thousand to private consumers. [The city desired that the contract be made at $16 for the one and $1.50 per thousand for the other.] It now transpires that the proposition made by company was adjusted to a figure of $25 per post, and $2 per thousand to consumers, which as will be seen agreed pretty closely with our ideas of what would have been equitable and proper to both parties in interest. At any rate the matter has been settled, and a new contract has been executed. The price to city for street lamps is fixed at $16 each per annum, and private consumers will pay at the rate of $1.50 per thousand—the agreement, we believe, to extend over a term of ten years. Any unprejudiced witness will at once concede that these prices are too low—by far too low when it is remembered that the maximum 24-hours' output of the Hillsboro plant has never exceeded 20,000 cubic feet.

To Build the Munich Regenerative Furnaces in the United States.—Messrs. Bartlett, Hayward & Co., the well-known firm of gas works constructors, whose headquarters are in Baltimore, Md., have added another branch to their already extensive lines of plant erection and equipment. They have secured the right to introduce and construct the Munich regenerative furnaces—system of Drs. Schilling and Bunte—in this country. Our next issue will contain a full-page advertisement devoted to a complete *resume* of the advantages claimed by this system.

An Item or Two from Richmond, Va.—The people of Richmond, Va., are now better satisfied than ever that the judgment of those who objected to and finally succeeded in preventing the water gas speculators from securing control of the Richmond gas works, was sound. The consumers are now receiving a good artificial light, at a low price, and the efficiency of the plant is greater than ever. Councilman Higgins and his associates who took such a firm stand, in the spring of '83, on the question of the city retaining its ownership of the gas works, have the satisfaction of knowing that subsequent events are in most thorough accord with their original predictions. Better than all, though, people now acquit them (some of the "voters" then claimed that Messrs. Higgins and his fellow workers were agitating the gas question for the sake of the profit that was concealed therein) of having possessed any other motives than those which might be traced to a desire to labor for the public good. The local electric lighting company is now underway in the chief city of the State known as the "Mother of Presidents," and so far has been most disappointing to those in charge of it. The lights are poor (the price charged for them is steep enough), and the service is bad; but, as usual, the "defects are soon to be remedied." How soon?

The Tiffin (Ohio) Gas Well.—A paragraph in a letter recently received by one of our correspondents, in dealing with the search for natural gas at Tiffin, says: "Our gas well is a complete fizzle. At no period did it produce over 10,000 cubic feet in 24 hours; and now, at times, the flow entirely ceases. All told, some 25 barrels of oil were taken from it. The well is standing idle, and no attempt is being made to utilize it. We shall prospect in one or two other likely spots, but do not expect to meet with success. When the gas from well above noted would issue from 2-inch pipe in bore hole at a pressure sufficient to keep up a flame, the light afforded might possibly equal that occasioned by a blazing tar barrel."

The Light of the Future at Portland, Maine.—Portland's streets are now lighted by electricity—that is, they are so lighted when the "arcs" are so minded. On the evening of Jan. 29th a severe storm visited that city. The trees in several portions of the town were thrown down on account of the great weight of ice which had accumulated on their trunks and branches, the fall of the "monarchs," of course, being accelerated by the violence of the wind. In their descent to "mother earth" telephone, light, and telegraph wires were ruptured; the arcs were extinguished, and darkness reigned supreme. At about 10 P.M. a disastrous conflagration broke out. Owing to the depth of snow in the streets, added to the darkness, the engines could make but little progress, and, as one of the daily papers there puts it, "Of all the nights that could be conceived of last night was one when a satisfactory system of street lighting was needed." Owing to this delay tens of thousands of dollars' worth of valuable property was destroyed that would have been saved were the gas lamps doing service. In the meantime arrangements have been made to partially light the streets of the city by gas "till it shall again become safe to employ electricity." Mayor Deering also suggests, "So long as the present condition of things exists, which prevents the lighting of the electric lights, let every citizen contribute to lighting the street on which he lives, so far as possible, by placing a lighted *lamp* in a window fronting the street." These are some of the excellencies of electric street lighting as shown in Portland. Next!

Cheaper Gas for Fitchburg, Mass.—Mr. Coggshall, Treasurer of the Fitchburg Gas Company, informs us that another reduction in selling rates has been granted the company's consumers, the new rate having taken effect on first day of present year. The company now charges $2 per thousand, when accounts are settled within 20 days from time of presentation. The original gas rate at Fitchburg was $5 per 1,000, and Bro. Coggshall says that bottom figures are by no means yet recorded. We might also add that the Treasurer is a firm believer in the merits of the Rappelye automatic governor.

Mr. Brewer Retires from the Treasurership of the Springfield (Mass.) Gas Company.—Shortly before the hour set apart for holding the annual meeting of the Springfield Gas Company (Monday, Jan. 25th), Mr. Jas. D. Brewer informed his brother officers that he would not consent to a re-election to the office of Treasurer. Mr. Brewer has been connected with the company since 1847 (year when it was chartered), was its President from 1850 to 1860; and was its Treasurer from 1860 to 1886. He still remains in the board of direction, and his associates thereon for current year are Messrs. M. Chapin, E. Gunn, J. A. Rumrill, S. W. Porter, H. S. Lee, and W. Merrick. The last named gentleman was selected to occupy the vacancy caused by Mr. Brewer's voluntary retirement. Mr. Merrick is the son of Solyman Merrick, who was the company's first President. Some other matters connected with Mr. Brewer's resignation will be discussed in next issue. Lack of space is the reason why they are now omitted. [Later information contains the sad news that Mr. Brewer died on evening of Sunday, Feb. 7th. Our promised recital of pleasant things said and done at board meeting above referred to is therefore and with startling suddenness to be altered to a short record of his life and works—a sad task imposed upon us by the cruel hand of death.]

Not Successful at Lawrence, Mass.—During June, 1885, Major Merrill, editor of the Lawrence *American*, and postmaster of that city, made application (on behalf of himself and associates) to City Council for the right to open the streets and put down gas mains. As no company had been formed it is fair to suppose that their idea was to secure the right before the appointment of the Gas Commission. The Lawrence Gas Company remonstrated and asked for a hearing; this was allowed. The applicants for right secured the services of an expert in the person of Burdett Loomis, who was eloquent in his expatiation over the beauties of water gas, etc. Agent Humphreys (of the Lawrence Company) presented the reverse side of the "beauties," testifying at some length on the known results of competition in gas supply as shown in other cities; strong points being made of the standing enjoyed by Brooklyn, New York, New Orleans, Baltimore, etc., in respect of "opposition" companies. The comparison was further enhanced by reference to state of affairs in other cities not yet given over to "oppo-

sition" tacticians. The dangers of water gas were portrayed in a clear manner, good use being made of the facts contained in the now famous report of the Massachusetts Board of Health. Among the technical objections raised was one holding that Council could not grant the right to one man and "associates," particularly when the one man declined to name who his associates were. When the Council adjourned nothing more was heard about the affair until near end of December last. It might be proper here to explain that the City Government of Lawrence was in the hands of the Republicans during '85, but democratic successors were chosen to hold the reins of power in '86. Just before the '85 Council were going out of office a communication was received from Maj. Merrill (signed by him as one of the incorporators of the "Merrimac Gas Company," and accompanying which was a certificate of proposed incorporation, explaining that the capital of company was put at $5,000, etc.) asking substantially for the privileges originally petitioned for. The Lawrence Company demanded a new hearing; but the Merrimac folks claimed that a hearing had already been accorded; and that this action was really but a continuation of the June proceedings. The Lawrence folks contended that as proposed certificate of incorporation was dated "December," no combination of the associates could have existed in June. One of the signers was Mayor of the city, and the others were prominent residents of Lawrence. When a test vote was taken the prayer of petitioners was denied. It received two affirmatives out of a total of six votes cast. And so ended the "Merrimac Company's" attempt.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Mr. Slater "is of the Same Opinion Still."

PROVIDENCE GAS COMPANY, MARKET SQUARE,
PROVIDENCE, R. I., Feb. 5, 1885.

To the Editor AMERICAN GAS LIGHT JOURNAL:

My attention has been called to the comments of the *Journal of Gas Lighting* on the subject of three-hour charges—republished in your issue for Jan. 16th—in which reference is made to the paper* read by me before the Society of Gas Lighting. In one paragraph of said comments I read, "that the convenient duration of charges is a matter upon which every experienced manager has his mind fully made up." Were that statement true, in its fullest sense, then we might say "good bye" to progress in the matter of carbonization of coal for the production of gas! However, in the very next sentence written by the commenter we discover him saying, "It is true that the ultimate capacity of coal for producing luminous gas is as yet unknown," etc. So far, he is in substantial agreement with the opening sentence of my paper. It reads, "The question, 'What are the best conditions to be maintained in the distillation of coal for the manufacture of illuminating gas?' is one upon which a variety of opinions still exist," etc.

It is, perhaps, fortunate that such is the case; for, were it otherwise, we would all now be found traveling in the same old ruts marked out by our grandfathers many years ago. I do not mean to be understood as indiscriminately advocating the system of three-hour charges, because the conditions necessary to advantageous working would not always be present. If the conditions under which three-hour charges are advantageous be impossible of attainment, then I submit that we at Providence must be very stupid (after an experience of over five years' continuous working under that system—and, during the greater portion of that time, following out the practice at both of our stations) not to have made the discovery that it would inure to our advantage (as compared with four or six-hour charges) did we discontinue the three-hour system.

I next quote the first objection raised by the commenter against three-hour charges: "The heat that must for such a purpose be maintained in the retorts, although obtainable with comparative ease from gas furnaces, must necessarily be very trying to the settings." I have often said, and experience has confirmed me in the claim, that an erroneous opinion exists in regard to the destructive effect of *heat* on our benchwork. Good refractory material, or such as is to be found in common use in the better class of benchwork erected in this country, will endure the effect exerted by a reasonably high heat, provided that that heat be *uniformly and steadily maintained.* A slight measure of careful observation will confirm the assertion that the greatest damage done to settings may be traced to and is caused by unsteady and variable heats—which must necessarily prevail with any style of furnace where (when it becomes obligatory to remove the clinker that has adhered to walls of furnaces) the fire has to be entirely dropped to permit of the cleaning process. The removal of this clinker takes up time—proportioned to the obstinacy of the substance—consequently the setting is subjected to drafts of cold air.

I am not surprised to read that "the bulk of the gas produced in these islands [British] is still made from six-hour charges;" but not one reason is advanced as to why the system of six-hour charges meets with such continued favor! Shall we infer the six-hour schedule is likely to "go on forever"—for I have already quoted the commenter as saying, "Every experienced manager [there] has his mind fully made up," etc. Again, the question of labor, wear and tear, "pitch, formed like muckle stanes in red-het ascension pipes," are noted, among others, as objections which "would speedily condemn the three-hour charges in the eyes of a manager who does not desire to spend the greater part of his time in the retort house." As I fear that I have already taken up too much of your valuable space, I will answer the question of labor by saying that although we are now paying more for ordinary labor in the retort house (not, however, because we run three-hour charges) than we did in 1880 (when we were running four-hour charges), yet the cost per thousand cubic feet of gas for that item is less now than it was then. Whatever the wear and tear may be, our books are witnesses to prove that we now get more gas during the lifetime of a retort than was formerly obtained under the four-hour plan. As to trouble with ascension pipes, pitch, etc., we are not sensible of having additional bother from such sources now as compared with our experience when four-hour charges were the rule.

We must confess that we do spend some of our time in the retort house; and, as that is the most important department in any gas works, we consider it time well spent. If some managers would devote more of their time to their retort houses, and occupy that time in close observation of conditions and results, doubtless more rapid progress would then be seen. I cannot say that I am familiar with the "benchwork" of our English friends, and have little doubt but that conditions obtain there which, under their circumstances, may perhaps justify them in still adhering to six-hour charges—for I certainly have great respect for the ability shown by English gas engineers.

I have been a reader of the *Journal of Gas Lighting* for many years, and have learned to respect its discussions on matters related to the gas industry; but, so far as this particular policy is concerned, I consider we have *facts* to put against the *opinions* referred to—and to the facts we hold.

Truly yours, A. B. SLATER.

* See JOURNAL, Dec. 2, 1885, p. 282.

The Explosion at the Kansas City Works.

OFFICE KANSAS CITY GAS LIGHT AND COKE CO.,
KANSAS CITY, MO., January 25th, 1886.

To the Editor AMERICAN GAS LIGHT JOURNAL:

As noted in the JOURNAL some time ago, a most violent and disastrous explosion occurred in the purifying house of this company on the morning (1:10 o'clock) of Dec, 9, 1885. The bottoms of all the boxes were badly damaged; the one in southeast corner of the room was a total wreck, and scarcely any of the plates of the others were available. We did manage to put one together by piecing out; but this is now being replaced, and when the operation is completed we will have an entirely new equipment consisting of four boxes.

The damage to tops of boxes destroyed was caused by the falling in of roof. The condensers were undisturbed, save water and steam connections thereto—but all these latter were broken. The exhauster and engine were badly injured by the *debris* that fell upon them. Neither retort house nor meter room proper was damaged—the roofs of each sustaining slight injuries from flying brick, etc. The glasses in office windows were all blown out. It occupied the entire time of a force of ten men during six days to clear out and remove the ruins and wreckage. In fact, I might say that not a single part of the works escaped damage more or less severe.

The building destroyed was 120 ft. by 48 ft., and 22 ft. in height, and inclosed the condensers, exhauster, engines and boilers, and purifiers. It was erected in 1879; the walls were well constructed, and of a thickness of 18 inches. All cross-walls were carried up to the roof. A solidly built wall cut off the condensers from purifier room. Now imagine this structure almost level with the ground—in fact, hardly three courses of brick remaining on foundation walls, and slates from the roof were transported over a distance of 250 feet—and you will have some idea as to how I felt when I first beheld the scene of disaster.

As to the cause, we feel certain that it originated in malice. The stokers were drawing their 1 o'clock charge, and everything was working smoothly, when, as one of the firemen puts it, "I saw a flash along the ground under the wrecked purifier, and instantly came the crash." The engineer had just left his engine and gone into the boiler room, at the time of which visit he reports everything was "all right." He was rather badly hurt by the falling timber and brick, but has since recovered. The night foreman says he went through the purifying house, as was his usual custom, at 11:30 P.M., and found everything in good order. Putting everything together, we think the men who "struck" on us last September could explain about the explosion.

However, we did not stop to discover how it came about, but set to work at finding out in how short a space of time we could furnish light to the city. The "burning cry" of the hour was, "When can we have gas?" We promised to make them a "light" Christmas gift; and by working day and night, aided by splendid weather, we managed to keep our word.

I wish to return thanks to my friends for their sympathy and offers of assistance (both by telegram and letter), and assure them their kindness was fully appreciated. Respectfully, HARRY E. CLARKE, Supt.

The Market for Gas Securities.

The market for city gas shares has attracted great attention during the fortnight, the trading in Consolidated stock—as shown by official reports of a single day's sales on Stock Exchange, when about 9,000 shares changed hands—being the especial feature. Our last quotation for Consolidated was 102 bid, but between then and now the security has sold at as high as 111½. To-day (Sat., Feb. 13, 2:30 P.M.) we have a record of ten shares sold at 108—with closing bid and asking prices at 107½ to 108, respectively. A rumor has been "going the rounds"—we give it as mere rumor, remember—that some sort of a truce has been agreed upon between the Consolidated and Equitable Companies in the matter of gas supply to the metropolis. The "stiffening" experienced in values of both stocks would appear to support the gossip indulged in. Equitable is at 144 bid, 147½ asked. Brooklyn shares are dull. As an evidence of strength of Eastern gas shares we note that a transfer of East Boston gas was recently effected at a premium of 64 points. The capital of East Boston Company is $220,000; and par of shares is $25.

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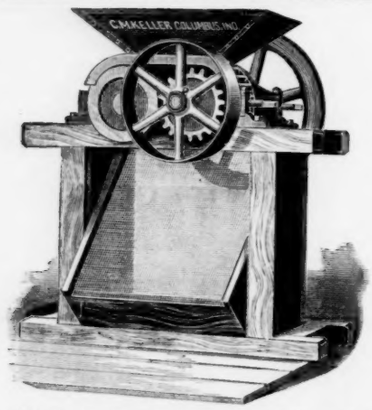

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